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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/666,587	09/18/2003	Shuming Nie	50508-1100	1656
24504	7590	09/20/2004	EXAMINER	
THOMAS, KAYDEN, HORSTEMEYER & RISLEY, LLP 100 GALLERIA PARKWAY, NW STE 1750 ATLANTA, GA 30339-5948			YU, MELANIE J	
			ART UNIT	PAPER NUMBER
			1641	

DATE MAILED: 09/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/666,587	NIE ET AL.	
	Examiner	Art Unit	
	Melanie Yu	1641	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-58 is/are pending in the application.
- 4a) Of the above claim(s) 30-52 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-29 and 53-58 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>18 September 2003</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-29 and 53-58 are drawn to a structure comprising a nanospecies and a porous material, classified in class 436, subclass 518.
 - II. Claims 30-45 are drawn to a method preparing a structure comprising a nanospecies and a porous material, classified in class 427, subclass 196.
 - III. Claims 46-52 are drawn to a method of detecting at least one target, classified in class 435, subclass 7.2.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions of group I and group II are related as process of making and product made.

The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the structure can alternatively be made by incorporating the nanospecies during the production of the porous material.

3. Inventions of group I and group III are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that

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product (MPEP § 806.05(h)). In the instant case the structure can alternatively be used as a separation and filtration device for analyte.

4. Inventions of group II and group III are unrelated and patentably distinct. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions have different functions. The method of group II requires forming a structure, which is not required of group III. The method of group III requires detecting at least one of a second detectable characteristic, which indicates the presence of the target in the sample, and is not required of group II.

5. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

6. During a telephone conversation with Mr. Christopher Linder on August 26, 2004 a provisional election was made with traverse to prosecute the invention of group I, claims 1-29 and 53-58. Affirmation of this election must be made by applicant in replying to this Office action. Claims 30-52 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

7. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Objections

8. Claim 28 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 28 is dependent on claim 27, however they are identical; therefore claim 27 fails to further limit the structure.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-29 are rejected under 35 U.S.C. 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which application regards as the invention.

Claim 1 is indefinite because it is unclear whether a first characteristic of the nanospecies is the same first characteristic of the porous material. It is also unclear how the first characteristic causes the nanospecies to interact with and become disposed in the porous material. If the first characteristic is a hydrophobic characteristic, as recited in claim 8, it is unclear how the hydrophobic characteristic of the porous material causes the nanospecies to interact with the porous material and become disposed in the pores of the porous material.

Claim 8 is indefinite because it is unclear what the recited term "biological characteristic" means.

Claim 11, 12, and 14-24 are indefinite because the claim recites that a hydrophobic compound is substantially disposed on the semiconductor quantum dot, but fails to specify an

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amount sufficient for substantial disposal. It is noted that the applicant states a sufficient disposal in the specifications, but does not disclose an amount for sufficient disposal.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

11. Claims 1, 2, 6, 8, 9, 26-28, and 53-58 are rejected under 35 U.S.C. 102(b) as being anticipated by Polak et al. (U.S. patent 6,379,622).

Polak et al. teach a structure comprising: a nanospecies being a quantum dot (col. 5, lines 30-39) having a first characteristic of a ligand-receptor (col. 7, lines 7-16 and 27-30) and a second detectable characteristic of fluorescence (col. 7, lines 10-12), wherein a second detectable energy is produced corresponding to the second detectable characteristic upon exposure to a first energy (col. 2, lines 24-32; col. 3, lines 4-20); and a porous material being cellulose (col. 6, lines 11-20) and having the first characteristic and a plurality of pores (col. 7, lines 14-44), where the first characteristic causes the nanospecies to interact with the porous material to become disposed in the pores of the porous material (col. 4, lines 65-67; col. 5, lines 1-5; col. 8, lines 24-35).

With respect to claims 53-58, Polak et al. anticipate such claims because Polak et al. discloses all limitations recited in the claims, as discussed above. The only difference between

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claims 53-58 and claim 1 are the intended use recited in the preamble. Statements of purpose or the recitation in the preambles of claims 53-58 have not been given patentable weight because it has been held that a preamble is denied the effect of a limitation where the claim is drawn to a structure and the portion of the claim following the preamble is a self-contained description of the structure not depending for completeness upon the introductory clause. *Kropa v. Robie*, 88 USPQ 478 (CCPA 1951).

With respect to claims 26-28, Polak et al. teach a probe of a fluorescently labeled biomolecule linked to a quantum dot, which is attached directly to the porous material (col. 1, lines 67; col. 3, lines 1-11; col. 6, lines 28-33).

12. Claims 1-4, 6, and 8-10 are rejected under 35 U.S.C. 102(e) as being anticipated by Thayer et al. (U.S. patent 6,528,323).

Thayer et al. teach a structure comprising: a nanospecies being metal or a biomolecule (col. 2, lines 3-5 and 48-65) having a first characteristic of an antibody-ligand (col. 15, lines 5-19; col. 15, lines 57-63) and a second detectable characteristic of fluorescence (col. 14, lines 37-57; col. 17, lines 64-67; col. 18, lines 1-10), wherein a second detectable energy is produced corresponding to the second detectable characteristic upon exposure to a first energy (col. 2, lines 3-5 and 48-65); and a porous cellulose material (col. 13, lines 15-21) having the first characteristic and a plurality of pores (col. 7, lines 1-6; col. 13, lines 3-21), where the first characteristic causes the nanospecies to interact with the porous material to become disposed in the pores of the porous material (col. 2, lines 48-65). Thayer et al. also teach the metal further being gold, and the biomolecule further being a ligand (col. 14, lines 5-17; col. 15, lines 6-19). Thayer et al. also teach the nanospecies coated with a chemical compound, wherein the

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nanospecies has the first characteristic after being coated with the chemical compound (col. 2, lines 37-40; col. 13, lines 15-21).

13. Claims 1 and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Ching et al. (U.S. patent 5,120,643).

Ching et al. teach a structure comprising a nanospecies having a first characteristic and a second detectable characteristic, wherein a second detectable energy is produced corresponding to the second detectable characteristic under exposure to a first energy (col. 8, lines 47-67; col. 9, lines 1-3); and a macroporous material (col. 24, lines 3-8) having the first characteristic and a plurality of pores, where the first characteristic causes the nanospecies to interact with the porous material and become disposed in the pores of the porous material (col. 9, lines 11-50).

14. Claims 1 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Speakman (U.S. patent 6,503,831).

Speakman teaches a structure comprising a nanospecies having a first characteristic and a second detectable characteristic (col. 5, lines 65-67; col. 6, lines 1-14; col. 8, lines 44-67; col. 9, lines 16-26), wherein a second detectable energy is produced corresponding to the second detectable characteristic upon exposure to a first energy (col. 5, lines 43-49); and a porous material being silica (col. 45, lines 37-42) and having a hydrocarbon-derivatized surface (col. 44, lines 29-31 and 62) having the first characteristic and a plurality of pores (col. 9, lines 26-49), wherein the first characteristic causes the nanospecies to interact with the porous material (col. 5, lines 31-54) and become disposed in the pores of the porous material (col. 9, lines 16-26).

15. Claims 1, 25, and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Tyagi et al. (U.S. patent 6,103,476).

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Tyagi et al. teach a structure comprising a nanospecies having a first characteristic and a second detectable characteristic, wherein a second detectable energy is produced corresponding to the second detectable characteristic upon exposure to a first energy; and a porous material having the first characteristic and a plurality of pores, where the first characteristic causes the nanospecies to interact with the porous material and become disposed in the pores of the porous material (col. 1, lines 16-26). Tyagi et al. teach the structure further comprising a probe attached to the porous material, and a fluorophore and a quenching moiety attached to the probe (col. 1, lines 49-57; col. 2, lines 6-12).

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The inquiries for establishing whether an invention is obvious over the prior art in accordance with *Graham v. John Deere*, 383 U.S. 1,148 USPQ 459 (1966) can be summarized as follows:

1. Determine the scope of the claimed invention
2. Determine the scope and content of the prior art.
3. Determine if there are any differences between the claimed invention and the prior art.
4. Determine if any differences are such that the invention would have been obvious to one of ordinary skill in the art.

17. Claims 11-16 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Polak et al. (U.S. patent 6,379,622) in view of Bawendi et al. (U.S. patent 6,251,303).

Polak et al., as disclosed above, teach the structure recited in claim 1, but fails to teach the nanospecies being a hydrophobic coated semiconductor quantum dot.

Bawendi et al. teach a hydrophobic coated semiconductor quantum dot, wherein the coating includes a hydrophobic compound substantially disposed on the semiconductor quantum dot (col. 3, lines 29-35), in order to create nanocrystals that are highly luminescent and stable in aqueous solutions, to prevent charge transfer across the region, and to maintain the desired isolation between individual quantum dots (col. 6, lines 11-13; col. 7, lines 44-56).

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Polak et al., a hydrophobic coated semiconductor quantum dot as taught by Bawendi et al., to prevent the dissociation from the binding surface and the degradation of fluorescence.

With respect to claims 12-16, Bawendi et al. teach the hydrophobic compound being an $O=PR_3$ compound, wherein R is a saturated linear C_4 to C_{18} hydrocarbon (col. 11, lines 16-35). Bawendi et al. also teach the hydrophobic compound being tri-n-octyl phosphine (col. 1, lines 52-55; col. 7, lines 49-56).

With respect to claim 19, Polak et al. teach a quantum dot comprising a core and a cap (col. 4, lines 49-52).

18. Claims 20-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Polak et al. (U.S. patent 6,379,622) in view of Bawendi et al. (U.S. patent 6,251,303) as applied to claims 1 and 11, and further view of Nie et al. (U.S. patent 6,468,808).

Polak et al. and Bawendi et al., as disclosed above, teach the structure comprising a nanospecies and a porous material with a hydrophobic quantum dot with a core selected from II-

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VI, III-V, and IV semiconductors, but fail to teach the core of the quantum dot selected specifically from IIB-VIB, IIIB-VB, and IVB-IVB semiconductors.

Nie et al. teaches the suitable core of a quantum dot being selected from the group consisting of IIB-VIB semiconductors, IIIB-VB semiconductors, and IVB-IVB semiconductors (col. 3, lines 45-62), in order to preserve the biological activity of the biomolecule.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Polak et al. and Bawendi et al., a quantum dot as taught by Nie et al., in order to create a more stable luminescent quantum dot that can retain luminescent properties.

Nie et al. also teach the core of the quantum dot further being CdS or CdSe (col. 3, lines 59-62) and the cap being selected from the group consisting of IIB-VIB semiconductors of high band gap, the cap further being selected from ZnS and CdS (col. 4, lines 1-6).

19. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Polak et al. (U.S. patent 6,379,622) in view of Efros et al. (U.S. patent 6,642,538).

Polak et al., as disclosed above, teach a structure comprising a nanospecies and a porous material, but fail to teach a quantum dot coated with a hydrophobic compound including stearic acid.

Efros et al. teach a semiconductor nanocrystal made of a semiconducting material, which is a quantum dot, passively coated with stearic acid (col. 4, lines 16-44), in order to serve as a natural tunneling barrier.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Polak et al., a hydrophobic quantum dot as

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taught by Efros et al., in order to provide additional stability to the quantum dot by isolating the surface of the active portion of the nanocrystal from the effects of the environment and prevent the binding substrate from absorbing a majority of the excitation of the fluorescent label.

20. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Polak et al. (U.S. patent 6,379,622) in view of Damle et al. (Multilayer Langmuir-Blodgett assemblies of hydrophobized CdS nanoparticles by organization at the air-water interface. J. Mater. Chem., 2000, 10, 1389-1393).

Polak et al., as disclosed above, teach a structure comprising a nanospecies and a porous material, but fail to teach a quantum dot coated with a hydrophobic compound including octyldecyl amine.

Damle et al. teach a semiconductor nanoparticle that may be rendered hydrophobic by immersing the nanoparticles in octadecylamine and creating a lipid film on the nanoparticle (pg. 1389, left col., first paragraph; pg. 1390, right col., second paragraph, first sentence), in order to disperse the particles on the surface of water. It is noted that the nanoparticle is a quantum dot because it is made from semiconductive material. It is noted that octyldecyl amine was disclosed in the specification as a hydrophobic compound, but octadecylamine was used as the hydrophobic compound in Example 2, therefore either octyldecyl amine or octadecylamine could be used as the compound.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to include in the device of Polak et al., a hydrophobic quantum dot coated with a compound including octadecylamine as taught by Damle et al., in order to provide a hydrophobic coating for stability of the quantum dot and the fluorescence.

Conclusions

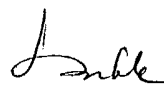
No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melanie Yu whose telephone number is (571) 272-2933. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Long Le can be reached on (571) 272-0823. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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09/17/04